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2 **Amendments to the Claims**

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4 Claim 1 (original): Apparatus for controlling the polarization of an incident beam of  
5 electromagnetic radiation comprising:

6 photonic crystal means, and

7 means for directing said incident beam of electromagnetic radiation at said  
8 photonic crystal means,

9 wherein said photonic crystal means comprises a crystalline lattice having cells  
10 with a defined periodic geometry that produces a polarization-dependent band structure by  
11 interference between Bragg reflections from many material interfaces for electromagnetic  
12 radiation.

13  
14 Claim 2 (original): The apparatus of claim 1 wherein said beam propagates in the plane  
15 of periodicity of a two-dimensional (2D) photonic crystal.

16  
17 Claim 3 (original): The apparatus of claim 1 wherein said beam propagates in any  
18 direction in a three-dimensional (3D) photonic crystal.

19  
20 Claim 4 (original): The apparatus of claim 1 wherein said beam is a polarized beam of  
21 EM radiation and wherein said photonic crystal means includes a transparent spectral region  
22 at a lower frequency than the fundamental band gap or between two band gaps, and that  
23 portion of said beam in said transparent spectral region is transmitted through the crystal and  
24 the polarization of said transmitted beam is altered by said photonic crystal means, whereby  
25 said crystal functions as a waveplate.  
26

1 Claim 5 (original): The apparatus of claim 1 wherein that portion of said beam having  
2 said first wavelength is exponentially attenuated by said photonic crystal means and is  
3 reflected so that said apparatus functions as a reflection waveplate.

4  
5 Claim 6 (original): The apparatus of claim 1 wherein said incident beam of EM  
6 radiation includes first and second polarization components, and wherein said photonic crystal  
7 means reflects said first polarization component and transmits said second polarization  
8 component, thereby functioning as a polarizer.

9  
10 Claim 7 (original): The apparatus of claim 5 wherein said transmitted beam and said  
11 reflected beam can have any angle relative to said incident beam, whereby said apparatus is  
12 not limited by Brewster's angle.

13  
14 Claim 8 (currently amended): An apparatus for maximizing conversion efficiency in  
15 nonlinear optical mixing processes between incoming, polarized optical beams and output,  
16 polarized optical beams comprising:

17 birefringent photonic crystal means composed of material with optical  
18 nonlinearity for achieving phase matching of said output beams with said incoming beams,  
19 wherein said birefringent photonic crystal means is adapted to reduce the wavevector  
20 mismatch  $\Delta k$  between said incoming and output beams to zero using said photonic crystal  
21 birefringence, and wherein said birefringent photonic crystal means is adapted to achieve  
22 phase matching without the use of or minimal use of angle tuning or temperature tuning.

23  
24 Claim 9 (canceled)

25  
26 Claim 10 (canceled)

1        Claim 11 (original): The apparatus of claim 8 wherein said photonic crystal means is  
2 composed of material which is not naturally birefringent.

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4        Claim 12 (canceled)

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6        Claim 13 (original): An optical apparatus for selectively changing a first known  
7 polarization of an input beam to a second, predetermined polarization of an output beam,  
8 comprising:

9                a photonic crystal means, and  
10                means for directing said input beam at said photonic crystal means,  
11                wherein said photonic crystal means comprises a crystalline lattice having cells  
12 with a defined periodic geometry that produces a band structure by interference between  
13 Bragg reflections from many material interfaces for electromagnetic waves.

14  
15        Claim 14 (original): A method of converting the polarization of an incoming beam of  
16 light from a first, known polarization to a second, selected polarization, comprising the steps:  
17                directing said incoming beam of light along a predetermined path,  
18                causing said incoming beam to enter a photonic crystal wherein said photonic  
19 crystal is adapted to convert said first polarization to said second polarization, and  
20                causing a beam of said second selected polarization to either be transmitted  
21 through or reflected off of said photonic crystal.

1        Claim 15 (original): An optical apparatus for creating a delay line arising from a  
2 transfer of energy between two different polarizations of electromagnetic (EM) waves,  
3 comprising:

4                birefringent crystal means,  
5                polarizer means in series with said birefringent crystal means, and  
6                means for directing said EM wave through said birefringent crystal means and  
7 said polarizer means,

8                wherein either a delayed or advanced transmitted electromagnetic waveform or  
9 wavepacket results by adjusting either the relative angular orientations of said birefringent  
10 crystal means, said polarizer means, and/or said incident EM wave polarization.